SEMESTER END EXAMINATION, DECEMBER 2024

Course Name: - B. Tech(CSE) Semester: - 3

Paper Name: - Discrete Mathematics Paper Code: - TCS 304

Time - 3Hrs + 20 minutes per hour extra time for V.I. & examinees with writer. Max Marks-70

समय – 3 घण्टे 20 मिनट प्रति घंटे अतिरिक्त–दृष्टिबाधित एवं सहलेखक परीक्षार्थियों के लिए। अधिकतम अंक–70

Instructions:

- The question paper consists of three sections namely A, B, C. All sections are compulsory.
- Section A- Each question carries **03** marks. All questions are compulsory.
- Section B- Answer any **5 out of 7** given questions. Each question carries **7 marks**.
- Section C- Answer any **2 out of 3** given questions. Each question carries **10 marks**.
- Section D- Each question carries **02** marks. All questions are compulsory.

Section – A
Objective Questions

1. **Answer all the following questions.** 5×3=15

(i) If A = {1, 2, 3} and B = {3, 4, 5}, what is A ∩ B?

a. {1, 2, 3}

b. {3}

c. {4, 5}

d. None of the above

(ii) A relation is an equivalence relation if it is:

a. Reflexive and symmetric

b. Symmetric and transitive

c. Reflexive, symmetric, and transitive

d. Reflexive and transitive

(iii) A partially ordered set is also known as a:

a. Lattice

b. Poset

c. Graph

d. Monoid

(iv) A function f: A → B is said to be injective if:

a. Every element of B is mapped by some element of A

b. Different elements of A map to the same element in B

c. Different elements of A map to different elements in B

d. None of the above

(v) The conjunction p ∧ q is true only when:

a. Both p and q are true

b. Both p and q are false

c. p is true, and q is false

d. p is false, and q is true

Section – B
Short Answer Questions

2.Answer any five of the following questions. **5×7=35**

(i) Define the power set and prove that if a set has n elements, its power set contains 2^n elements.

(ii) How many distinct permutations can be formed from the letters of the word "MISSISSIPPI"? Derive the formula used.

(iii) Prove that (p → q) is logically equivalent to (¬p ∨ q) using a truth table.

(iv) Given a set A = {1, 2, 3, 4} and a relation R = {(a, b) : a ≤ b}, represent R as a matrix and a directed graph.

(v) Define an Eulerian Walk and an Eulerian circuit. State the conditions under which a graph will have an Eulerian Walk or circuit.

(vi) A box contains 10 blue balls, 20 red balls, 8 green balls, 15 yellow balls, and 25 white balls. How many balls must we choose to ensure that we have 12 balls of the same color? Use pigeonhole principle.

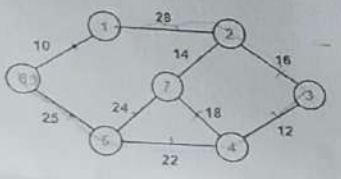
(vii) Prove that the following is a tautology or not:

$$(p \vee q \vee r) \Leftrightarrow [(((p \rightarrow q) \rightarrow r) \rightarrow r)]$$

Section – C
Descriptive Questions

3. Answer any 02 question of the following questions. **2×10=20**

(i) What is a minimum spanning tree. Construct the minimum spanning tree (MST) for the given graph using Prim's Algorithm.



(ii) Define Argument with example.
Test the validity of the argument:
If it rains, Ram will be sick.
It did not rain.
∴ Ram was not sick.

(iii) State different types of Sets. Let A,B,C be any three sets, then prove that:

$$A \times (B \cap C) = (A \times B) \cap (A \times C)$$

Section – D

Objective Questions

4. Answer all the following questions. 10×2=20

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1 Lagrange's Theorem is applicable in:

a. Rings

b. Fields

c. Groups

d. Sets

2 If 10 people each shake hands with 6 others, the minimum number of handshakes is:

a. 15

b. 30

c. 60

d. 45

3 A semigroup is a set with a binary operation that is:

a. Commutative

b. Associative

c. Invertible

d. None of the above

4 Which of the following is not a positional number system?

a. Binary

b. Octal

c. Roman

d. Decimal

5 What is the complement of the set A in a universal set U?

a. U - A

b. $A \cap U$

c. $A \cup U$

d. None of the above

6 The relation $R = \{(a, b): a < b\}$ is:

a. Reflexive

b. Symmetric

c. Transitive

d. None of the above

7 A partially ordered set in which every two elements have a least upper bound is called:

a. Lattice

b. Tree

c. Poset

d. Monoid

8 Which of the following is not a type of function?

a. Bijective

b. Injective

c. Subjective

d. Polynomial

9 Which of the following is a tautology?

a. $p \vee \neg p$

b. $p \wedge \neg p$

c. $p \rightarrow \neg p$

d. $\neg p \wedge q$

10 The statement 'All dogs are animals. Max is a dog. Therefore, Max is an animal.' is an example of:

a. Deductive reasoning

b. Inductive reasoning

c. Abductive reasoning

d. None of the above